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Indian Standard
METHODS FOR
SAMPLING OF AGGREGATES
FOR CONCRETE
(*First Revision*)

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Indian Standard
**METHODS FOR
 SAMPLING OF AGGREGATES
 FOR CONCRETE**
(First Revision)

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0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 28 November 1986, after the draft finalized by the Building Materials and Components Sampling Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Sampling is of equal importance to testing and a man drawing samples shall use every precaution to obtain samples that will show the true nature and condition of the materials which they represent.

0.3 One of the major contributing factors to the quality of concrete is the quality of aggregates used therein. It is, therefore, imperative that due consideration is given to sampling procedures which will help in the proper and objective evaluation of the quality of aggregates.

0.4 This standard was originally issued in 1969. This has been revised so as to make it more easily implementable in practice and bring it in line with the current national and international trade practices. [In this revised version, the weight of the gross sample and number of increments have been modified so that it may be more economical to use them in practice.]

0.5 In preparing this standard, assistance has been derived from the following publications:

ASTM/D 75-1982 Standard practice for sampling aggregates
ISO/DIS 4847 Concrete — Sampling of normal weight aggregates.

0.6 For reporting the results of a test or analysis, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard prescribes the methods of sampling for coarse and fine aggregates for the following purposes:

- a) Preliminary investigation of source of supply,
- b) Inspection of shipment of materials, and
- c) Inspection of materials on the site of work.

1.2 This standard also specifies methods of sample reduction, packing and forwarding them for examination and testing.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Aggregates — Crushed stone, crushed boulders, gravel, sand, industrial by-products or such other inert material.

2.2 Fine Aggregates — Aggregates most of which pass through 4.75 mm IS Sieve.

2.2.1 Natural Sand — Fine aggregates resulting from the natural disintegration of rock and which have been deposited by streams or glacial agencies.

2.2.2 Crushed Stone Sand — Fine aggregates produced by crushing hard stone.

2.2.3 Crushed Gravel Sand — Fine aggregates produced by crushing natural gravel.

2.3 Coarse Aggregates — Aggregates most of which are retained on 4.75 mm IS Sieve.

2.4 All-in Aggregates — Material composed of fine aggregates and coarse aggregates.

2.5 Lot — The quantity of aggregates of the same class, nominal size, source and offered for inspection at one time. The lot may consist of the whole or a part of the quantity ordered for.

2.6 Sub-lot — The quantity of aggregates in each of the parts into which a lot is divided for the purpose of sampling. As far as possible sub-lots should be of equal size.

2.7 Increment — The quantity of aggregates obtained by a sampling device at one time.

2.8 Unit Sample — The quantity of aggregates collected at one point in sectional sampling or at one time from the conveyor.

2.9 Gross Sample — Sample as collected from a sub-lot, that is, the quantity of aggregates consisting of one or several increments or unit samples taken from a sub-lot.

2.10 Laboratory Sample — The quantity of aggregates obtained by reducing a gross sample following a specified procedure and intended for laboratory testing.

2.11 Composite Sample (for the Lot) — The quantity of aggregates obtained by mixing together equal quantities from each of the laboratory samples.

3. SAMPLING FOR PRELIMINARY INVESTIGATION OF SOURCE OF SUPPLY

3.1 Stone from Ledges for Quarries

3.1.1 The ledge or quarry face of the stone shall be inspected to determine any discernible variations or strata. Differences in colour and texture shall be observed.

3.1.2 Separate samples having a mass of at least 25 kg of stone should be obtained from each discernible strata. The sample should not include material weathered to such an extent that it is no longer useful for the purpose intended.

3.2 Field Stone and Boulders

3.2.1 A detailed inspection of the deposits of field stone and boulders, over the area from where the supply is to be obtained, shall be made. The different kinds of stone and their condition in various deposits shall be recorded.

3.2.2 Separate samples shall be selected of all classes of stone that visual examination indicates would be considered for use in construction. These individual samples shall weigh at least 25 kg each.

3.3 Sand and Gravel (Road Side, Bank Run Sand and Gravel Deposits)

3.3.1 Road side production is the production of materials with portable or semi-portable crushing, screening, or washing plants established or reopened in the vicinity of the work on a designated project for the purpose of supplying materials for that project.

3.3.2 Potential sources of bank run sand may include previously worked pits from which there is an exposed face or potential deposits discovered through air-photo, interpretation, geo-physical exploration or other types of investigation.

3.3.3 Samples shall be so chosen from each of the different strata in the deposit discernible to the sampler. An estimate of the quantity of different materials shall be made.

3.3.4 If the deposit is worked as an open-face bank or pit, the sample shall be taken by channelling the face vertically, top to bottom, so as to represent the materials proposed for use. Over-burden and disturbed material shall not be included in the sample. Test holes shall be excavated or drilled at numerous locations in the deposit to determine quality of material and the extent of the deposit beyond the exposed face, if any. The number and depth of these test holes will depend upon the quantity of the material to be used, topography of the area, nature of the deposit, character of the material and potential value of the material in the deposit. Separate samples shall be obtained from the face of the bank and from test holes. If visual inspection indicates that there is considerable variation in material, individual samples shall be selected from the material in each well defined stratum. Each sample shall be thoroughly mixed and quartered, if necessary, so that the gross sample obtained will be of at least 12 kg for sand and 35 kg if the deposit contains an appreciable amount of coarse aggregates. If the deposit being investigated does not have an open face, sample shall be obtained entirely from test holes as outlined herein.

4. SAMPLING FOR INSPECTION OF SHIPMENT OF MATERIALS AND OF MATERIALS ON THE SITE OF WORK

4.1 The samples shall be selected and examined from each lot (*see 2.5*) separately.

4.1.1 For obtaining reliable conclusions, it is recommended that as far as possible aggregates be sampled when in motion, that is, from conveyors or during loading and unloading.

4.2 Sampling from Conveyors

4.2.1 *Sub-lots* — For the purpose of sampling a lot, while it is being discharged over a conveyor, shall be divided into a number of sub-lots of approximately equal size as specified in Table 1.

TABLE 1 NUMBER OF SUB-LOTS INTO WHICH A LOT IS TO BE DIVIDED

(*Clauses 4.2.1, 4.3.1 and 4.4.3*)

LOT SIZE (IN m ³)	NO. OF SUB-LOTS
(1)	(2)
101 to 500	3
501 to 1 500	5
1 501 to 5 000	7

NOTE — In case the lot contains 100 m³ or less of aggregates, the sampling shall be subject to agreement between the purchaser and the supplier.

4.2.1.1 A representative gross sample shall be drawn from each of the sub-lots and shall be kept separately. Thus there will be as many gross samples as the number of sub-lots into which the lot has been divided.

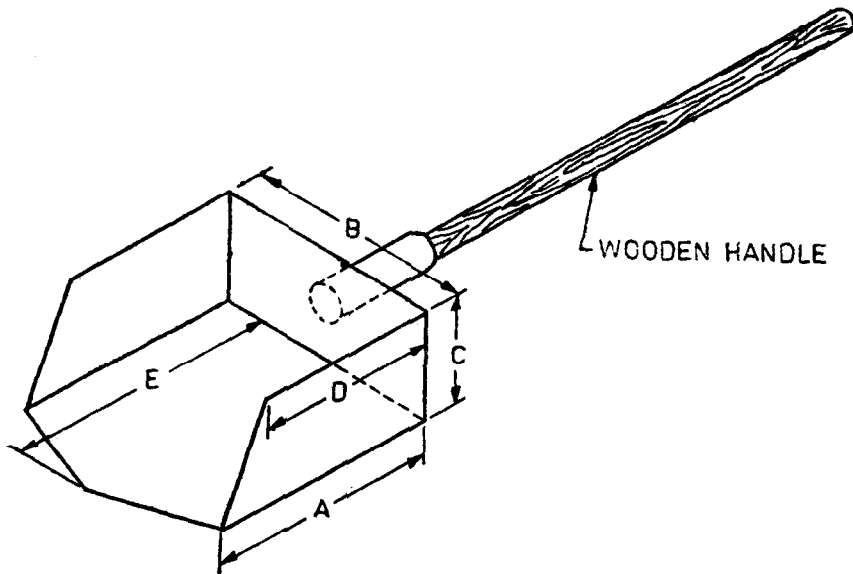
4.2.2 The weight of the gross sample shall depend on the maximum nominal size of aggregates and shall be according to Table 2. In order to obtain this weight of gross sample, at least 10 increments of a suitable weight, each not less than 1 kg, shall be taken. Increments shall be taken with the help of a suitable scoop (see Fig. 1) at regular intervals.

TABLE 2 WEIGHT OF GROSS SAMPLE

MAXIMUM NOMINAL SIZE OF AGGREGATES (mm)	MINIMUM WEIGHT OF GROSS SAMPLE (kg)
Fine Aggregates	
2.36	10
4.75	10
Coarse Aggregates	
9.5	10
10.0	10
12.5	15
13.2	15
16.0	20
19.0	25
20.0	25
25.0	50
37.5	75
40.0	80
50.0	100
63.0	125
75.0	150
80.0	160
90.0	175

NOTE 1 — For aggregates, the maximum nominal size of particles is the largest sieve size upon which any material is permitted to be retained.

NOTE 2 — For all-in-aggregates, minimum weight of gross sample shall be the mass of coarse aggregates (minimum) plus 10 kg.



Capacity of Scoop (kg)	Dimensions of the Scoop in mm				
	A	B	C	D	E
10	250	250	120	200	300
5	200	200	90	175	240
2	150	150	75	125	180

FIG. 1 SAMPLING SCOOP

4.2.2.1 The increments shall be taken at equal intervals preferably from the cross section and thickness of the stream in one operation. When the aggregates are in motion, the most reliable means of taking such increments is to sample at a point where the material discharges from the belt. The best possible increment is one which cuts across entirely the falling stream of the material by means of a suitable receptacle passed from one side of the stream to the other without allowing the receptacle to overflow. If the whole of the stream cannot be covered by one increment without overflowing the receptacle, the stream should be sampled systematically by taking material from all portions.

4.2.2.2 If it is not possible to sample satisfactorily at the point of discharge, increments may be drawn from the moving belt itself. In this case, the increments shall be collected from the centre and the left and right side of the belt along the same width. To ensure that very small material is also correctly obtained, a scoop should sweep the conveyor.

4.2.3 The material collected from various increments in a sub-lot shall be combined and mixed together to constitute a gross sample.

4.3 Sampling from Transportation Units (Wagons, Trucks and Boats)

4.3.1 *Sub-lots* — For the purpose of sampling, all the carriers (wagons/trucks/boats) in a lot shall be divided into a suitable number of sub-lots of approximately equal size in accordance with the requirements of Table 1.

4.3.1.1 A representative gross sample shall be drawn from each of the sub-lots and shall be kept separately. Thus, there will be as many gross samples as the number of sub-lots into which a lot has been divided.

4.3.2 In order to get a representative gross sample, the aggregates shall be sampled as far as possible when in motion, during loading or unloading.

4.3.2.1 A minimum of 25 percent of the carriers shall be selected at random from the sub-lot. For the random selection of carriers, the procedure given in 3.1 of IS : 4905-1968* may be followed. Ten increments shall be taken from the selected carriers and a suitable weight of the increment, not less than 1 kg, shall be used so that a gross sample of the quantity required in Table 2 is obtained. The increments shall be evenly distributed over the selected carriers with a

*Methods for random sampling.

view to determine the necessary number of increments that should be collected from each of the carriers in the sub-lot for making up the gross sample. These increments shall be drawn with the help of a suitable scoop (see Fig. 1) at regular intervals, at the time of loading or unloading of the carriers.

4.3.3 When the samples are to be collected from the loaded carriers, for collecting ten required increments, an equal number of points shall be located at random on the entire aggregate surface of all the carriers in a sub-lot. At every selected point, an increment shall be collected by the sectional sampling method.

4.3.3.1 *Sectional sampling* — At every selected point an increment shall be collected by taking the whole section of aggregates from top to bottom over the area of a circle of 20 cm diameter for aggregates more than 20 mm nominal size. For doing so, aggregate from the surface up to a depth of approximately 45 cm shall be collected at first. The bottom of the hole so formed shall then be covered by a plate and the aggregate lying on the sides shall be removed up to that plate so that, when the hole is dug further, the material from the sides does not fill up the hole by falling down. The procedure is repeated till the bottom is reached. For aggregates up to 20 mm nominal size and fine aggregates a sampling auger may be used in a casing pipe of 15 cm diameter and length slightly more than the height of the sub-lot. The casing pipe is pushed vertically down till it touches the bottom of the lot. The entire material from the inside of the casing pipe is removed by the auger to give an increment.

4.3.3.2 In sampling coarse aggregates from loaded carriers effort should be made to enlist the services of power equipment capable of exposing the material at various levels and random locations. When power equipment is not available the procedure given in **4.3.3.1** may be followed.

4.4 Sampling from Stacks or Stock Piles

4.4.1 For sampling material from stock piles or stacks, it is very difficult to ensure unbiased samples, due to the segregation which often occurs when material is stacked, with coarser particles rolling to the outside face of the pile. For coarse or all-in aggregates every effort should be made to procure a power equipment to develop a separate, small sampling pile composed of materials drawn from various levels and locations in the main pile after which several increments may be combined to compose the gross sample. If it is necessary to indicate the degree of variability existing within the main pile, separate samples should be drawn from separate areas of the pile.

4.4.2 Where power equipment is not available, samples from stock piles should be made up of the required number of increments taken

equally from *top third*, at the mid point and at the *bottom third* of the volume of the pile. A board put vertically into the pile just above the sampling point helps in preventing further segregation. In sampling stock piles of the aggregates, the outer layer which may have become segregated, should be removed and the sample taken from the material beneath.

4.4.3 Sub-lots — For the purpose of sampling, the quantity of aggregates in a stack shall be divided into a suitable number of sub-lots of approximately equal size in accordance with Table 1.

4.4.3.1 A representative gross sample shall be drawn from each of the sub-lots. Thus there will be as many gross samples as the number of sub-lots into which the lot has been divided.

4.4.4 Sampling of aggregates from stacks shall be carried out as far as possible, during the making (or breaking) of the stack.

4.4.4.1 A minimum of ten increments shall be taken from a sub-lot for making up a gross sample. The weight of the gross sample shall be according to Table 2 for various sizes of aggregates. The weight of the increment shall be governed by the weight of the gross sample and minimum number of increments i.e. 10. This weight of increment shall not be less than 1 kg. The number of increments shall be equally distributed over the sub-lot. Increments shall be drawn with the help of a suitable scoop (*see Fig. 1*) at regular intervals in the course of making or unmaking of the stacks.

4.4.5 When it becomes necessary to sample a stationary stack, trench sampling method (*see 4.4.5.1 and 4.4.5.2*) may be used. This method is applicable for stacks up to a maximum height of 1.5 m only.

4.4.5.1 The weight of the gross sample shall be according to Table 2 and minimum number of increments from a sub-lot shall be ten. These increments shall be collected according to **4.4.5.2**.

4.4.5.2 Along a randomly chosen line on the aggregates surface of the sub-lot, a trench shall be dug right down to the ground level. From the trenches so dug, the required number of increments shall be collected with the help of a suitable sampling scoop (*see Fig. 1*) at various points randomly spread over the two exposed sides of the trenches. In case of large stacks, in addition to the trench, the sides of the piles may also be opened to expose the aggregates down to the bottom at places where the trench does not expose the aggregates inside.

5. REDUCTION OF GROSS SAMPLE

5.1 Each gross sample shall be reduced separately. The process of mixing and reduction of each gross sample shall be repeated until the material required for each test, as specified in the relevant test method specification, IS : 2386 (Parts 1 to 8)-1963* is obtained.

*For titles of the various parts of IS : 2386, see page 12.

5.2 Reduction by Riffle Divider — The aggregates shall be well mixed and poured into the riffle. This process shall be repeated using different size riffles according to the size of the aggregates.

5.3 Coning and Quartering Method — The aggregates shall be mixed and then scooped into a cone-shaped pile. Care shall be taken to drop each scoopful exactly over the same spot as otherwise the central axis of the cone will be slackened and an uneven distribution of the particle sizes will result. After the cone is formed, it shall be flattened by pressing the top of the cone with the smooth surface of the scoop. Then it is cut into quarters by two lines which intersect at right angles at the centre of the cone. The bulk of the sample is reduced by rejecting any two diagonally opposite quarters. Accuracy in quartering is most easily attained, in the case of fine and all-in-aggregates, with damp material.

6. PACKING AND MARKING OF SAMPLES

6.1 Each sample shall be packed separately and despatched to the testing laboratory, great care being taken in packing to prevent the loss of any fine material.

6.1.1 Coarse aggregates shall be packed in secure containers or sample bags.

6.1.2 Fine aggregates and all-in aggregates shall be packed in tight containers or closely woven bags so that there is no loss of the finer particles.

6.2 Each package shall include a card, suitably protected from damage by moisture and abrasion, giving the name and address of the sender and the information required in **6.2.1**.

6.2.1 As much as possible the following information about the origin of the material shall accompany each sample:

- a) Name of the quarry, pit, river-bed, etc, and address;
- b) Proposed use for the material; and
- c) Geographic location, and shipping facilities.

7. NUMBER OF TESTS AND REPORTING OF TEST RESULTS

7.1 Unless otherwise stated each sample shall be tested individually for all the requirements and test results reported in accordance with IS : 2386 (Parts 1 to 8)-1963*.

*For titles of the various parts of IS : 2386, see page 12.

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Titles of Various Parts of IS : 2386.

- IS : 2386 (Part 1)-1963 **Methods of test for aggregates for concrete: Part 1 Particle size and shape**
- IS : 2386 (Part 2)-1963 **Methods of test for aggregates for concrete: Part 2 Estimation of deleterious materials and organic impurities**
- IS : 2386 (Part 3)-1963 **Methods of test for aggregates for concrete: Part 3 Specific gravity, density, voids, absorption and bulking**
- IS : 2386 (Part 4)-1963 **Methods of test for aggregates for concrete: Part 4 Mechanical properties**
- IS : 2386 (Part 5)-1963 **Methods of test for aggregates for concrete: Part 5 Soundness**
- IS : 2386 (Part 6)-1963 **Methods of test for aggregates for concrete: Part 6 Measuring mortar making properties of fine aggregate**
- IS : 2386 (Part 7)-1963 **Methods of test for aggregates for concrete: Part 7 Alkali aggregate reactivity**
- IS : 2386 (Part 8)-1963 **Methods of test for aggregates for concrete: Part 8 Petrographic examination**

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